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AVIATION
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America Aircraft Insurance

ONE of the things that a financier thinks of when contemplating an investment in an aviation enterprise, is insurance. Insurance has come to be such an important factor in modern business that few investors care to put their money in an enterprise which is not protected against accidental losses. The large insurance companies in this country have come to realize that aviation is bound to grow and hence will form a part of their field that is worthy of attention. They have not waited for sufficient business to produce an immediate profit but have gone ahead and built up organizations to find out the character of the business in order to handle it when the volume of business is sufficient to show a profit.

An organization known as the National Aircraft Underwriters' Association has been formed for the collection and dissemination of hazard statistics. At the present time the premiums for a pilot depend on his past record and the association is keeping careful records of the pilots on their list. This record also goes to determine the premiums of the companies employing a pilot. Records are also kept of the performance and reliability of the various airplanes on the market with a view of accurately determing the risk for each of them. These records are confidential and only available to the member companies.

Another indication of interest is the recent statement of the Underwriters' Laboratories that they are planning to examine aircraft and their accessories in the same manner that they have been handling automobiles and electrical supplies. This will furnish the various insurance companies with further data and will also give the manufacturers some assurance that purchasers of their products can get insurance on them.

Other countries have made efforts in this direction but none of them have seemed to be as thorough as those in the United States. The great importance of aviation is realized all over the world and aircraft insurance will soon be on a plane with the more ordinary forms abroad as well as in this country.

A Railway for Testing Airplanes

READERS will find in this issue a brief description of a German railway installation for testing full size airplanes. The work on this installation was interrupted by the signing of the armistice and no actual aerodynamic experimentation seems to have been completed. Yet, the railway apparently has given satisfactory results from the point of view of aerodynamics and of mechanical operation.

The inclusion of a high tower for carrying the object to be tested seems to have removed the main objection which has been raised in the use of previous installations of the kind, as at St. Cyr. The skillful arrangement of six measuring instruments allows the measurement of forces in all directions, both as regards magnitude and position. The use of recording instruments in combination with a powerful rotating drum would seem to render experimentation a matter of reasonable difficulty. Altogether the installation appears to be one of great engineering skill and obvious utility.

It is possible in testing a full sized plane to investigate a number of points which must remain obscure in the best equipped wind-tunnel. Thus, the exact investigation of radiator effects in combination with the airplane is something which a wind-tunnel can never solve effectively. The exact interaction of propeller and plane is another problem on which full size work will shed considerable light. Changes in fuselage resistance due to minor projections are almost imperceptible in the tunnel but may well be measured on the full size machine. We can never hope to duplicate in small scale experiments the effects of fabric deformation, and elastic deformation of the structure under load.

As against these advantages, a railway installation for testing full sized airplanes offers many difficulties. There must be a great initial expense; the cost of operation and upkeep would be relatively enormous. Owing to the complexity of the installation, the most painstaking work would never prevent break-downs, disappointing and vexatious delays. Weather conditions would have to be waited upon, and granted that the majority of errors in this type of work have indeed been eliminated, the errors due to cross-winds, up and down currents would be a perpetual source of trouble and inaccuracy.

It is by no means certain that the advantages would outweigh these difficulties.

American Engines

THE greatest weakness in the position of American aeronautics has always been the lack of variety of aviation engines. It is encouraging to learn that within a year this country will probably have adequate types of power-plants for all forms of heavier and lighter-than-air aircraft. The development of the low horsepower engine has been progressing and now there is a satisfactory motor of this type. The very high powered engines, too are coming into their own.

The initiative of the Engineering Section of the Air Service and the Naval Bureaus to give experimental orders for the types that are lacking is commendable, for only in this way can provision be made for every future contingency.

The engines that have been produced in this country which have either been original in their conception or adaptations of foreign models have now reached a point where all their idiosyncrasies have been mastered. It only remains for the Air Service to prepare the specifications of their requirements and give the American engine designers time to have a line of aeronautical power-plants in this country which can equal any in the world.

General Menoher's Annual Report

While the report of the Director of Air Service is dated in August, it has in it practically a summary of the Air Service of the Army as it exists today. By far the most important part of the report is the recommendations which are made at the end of the report. Regarding the future of aviation and the areonautical industry, General Menoher is clear and definite in his recommendations:

Federal Legislation on Air Navigation

The imperative need of federal legislation for the adequate control of various national and international matters connected with air navigation can not be too strongly emphasized. Commercial agencies engaged in the manufacture of aircraft or other development of aeronautics hesitate to apply themselves whole-heartedly to contructive programs, owing to the lack of such legislation to guide their efforts; the promulgation of varying rules and regulations by the several states of the Union, and the probability that federal legislation will present still other requirements, make it difficult for such concerns to undertake progressive development.

Rules and regulations for aerial traffic must embrace not alone those which make for safety in the air, but also those which provide uniform regulations for licensing pilots and aircraft, for the periodic inspection of aircraft, and for safe landing fields. They should include provisions for the adjustment of claims for injury or damages to persons or property resulting from the operation of aircraft, whether licensed or not, and should be so liberal in the provisions which cover the determination of responsibility for accidents that aerial transportation companies or other agencies directly concerned will not hesitate to assume the liabilities which might be incurred by them in the commercial operation of aircraft.

The control which the War Department exercised over air navigation during the World War ceased when the President withdrew from operation the proclamation which extended that power of control to the Army and the Navy. The need for such control since the armistice has been so great that several of the states have appointed aviation commissions to study the entire problem and to present, for the consideration of the governors of their respective states, drafts of proposed state legislation which would meet the local requirements. Several state legislatures have actually passed state laws providing for the regulation of air navigation within their borders, thus setting an undesirable precedent, which, if adopted by other states, would soon lead to serious confusion, owing to the fact that the legislation in each state will be framed to meet its own immediate needs, rather than the broad requirements of commercial aeronautics. Under such conditions, interstate transportation companies, or individual fliers, will be subjected to varying regulations, difficult to comply with. This office has exercised its influence, insofar as practicable, in advising state officials to discourage the enactment of state legislation prior to the time when Congress will pass federal legislation covering air navigation.

Federal Program for the Manufacture of Aircraft

The United States government should adopt, at this time, a continuing program for the manufacture of aircraft, and should make adequate appropriation therefor, in order to stimulate the aeronautical industry of the United States. Attention is invited to the fact that the close of the next fiscal year will disclose the deterioration, from either use or storage, of practically all the airplanes which were purchased during the war for the Army to the point where they willl be unsafe for flying. Adequate replacement will have to be made in order to enable the Air Service to meet not only its operating needs in carrying out its functions as a combatant branch of the Army, but also its present responsibility as the prime governmental agency to cooperate with other bureaus or departments of the Government in the use of aircraft for their purposes.

Aside from this there must be considered the fact that in time of war this country must again rely upon the aeronautical industry and the facilities which commercial aeronautics will make available for its use. Modern industry requires great foresight in planning the objectives upon which it hopes to realize financial return. Unless the government recognizes this business principle it cannot hope to depend, for its war needs, upon the availability of suitable commercial aircraft and facilities for their employment, nor upon the existence of manufacturing plants and supplies of materials necessary for the rapid production of aircraft. In order properly to foster the aeronautical industry, the government should announce, by legislative enactment, a policy which will provide for the manufacture of aircraft, covering a period of from three to six years, and must at the same time provide the necessary assurance that funds will be appropriated therefor annually during the continuances of the policy.

Liberal War Department Policy Toward Training of Air Service Offices of Officers' Reserve Corps

Congress having made adequate provisions for the federal reserve and for the training of officers of the Reserve Corps and their call to active duty under certain conditions, it is believed that the best interests of th Air Service and of the government will be served if special consideration is given to the recommendations previously made by this office with regard to building up a strong military reserve of qualified flying officers in this country.

Experience clearly dictates that reserve officers must continue to fly frequently, after passing into the reserve, in order that they may retain a reasonable degree of flying efficiency. The opportunity for continuing such flying should be carried to these reserve officers by the establishment of small, federal owned or supported flying fields in the vicinity of populous centers, where the majority of reserve officers reside. Such fields, of course, should be made to further all aviation purposes in which the government is directly or indirectly interested, such as mail carrying and commerce.

The present reserve of flying officers consists almost entirely of those who served during the World War. Their usefulness as fliers will not endure probably beyond a period of five years, by the end of which time replacement by newly qualified flying officers should be effected.

In order to provide the proper nucleus of efficient flying personnel, both in the Army Air Service and in the reserve, provision should be made for the retention, with their consent, on active duty, as reserve officers, for a period of one year, of approximately 500 of the graduated flying cadets provided for by the reorganization act, approved June 4, 1920. Upon completion of this period of active duty, such officers should pass into the reserve for the remaining period of the five years for which they are commissioned as reserve officers. While on inactive reserve status, they should be given opportunity for flying, as suggested above.

It is believed that only by such an arrangement will the Army Air Service be able to build up and maintain in any proper degree of efficiency a corps of Reserve flying officers which, if called to active duty in an emergency, will be able to meet the Army requirements for trained Reserve personnel.

The first section of the report deals with that past and present organization of the Air Service. The functions of the Joint Army and Navy Board, The Aeronautical Board, Board of Surveys and Maps, Ordnance Technical Staff, and the War Department Technical Committee are given and conclusions reached.

Conclusions on Proposed Department of Aeronautics

The attitude of the Director of Air Service is correctly set forth in the following conclusions arrived at and adopted by the Board of Officers, convened to report upon the creation of an executive Department of Aeronautics, of which board the Director of Air Service was the president.

(1) Peace-time air fleets at all adequate in size for war needs can not be maintained by any nation. The great air fleets necessary for war must be produced after war begins.

(2) To provide facilities for aircraft production at the beginning of war commercial aeronautics must be developed.

(3) Under present conditions, the only effective stimulant to the development of commercial aeronautics is government assistance in large annual appropriations guaranteed for a period of a considerable number of years. If this policy be adopted by the Government, these appropriations, in order to accomplish the result desired, must be continued until commercial aeronautics can stand by itself as a dividend-paying business.

(4) The government itself should not undertake the production of aircraft in government factories unless trade combinations in the production of military aircraft should eventually be formed against it.

(5) Federal agencies should be provided for the adequate control of various national and international matters connected with aeronautics.

(6) A single government agency should be responsible for the procurement of all aircraft used in the government service.

(7) A single government agency should have charge of all development work, in so far as same is common to all branches—military, naval, and commercial. This agency should be provided with the means to carry on experimentation and research.

The Secretary of War, being keenly alive to the necessity of coordinated action along the lines indicated above and to the interests of all government departments and of commercial aviation, initiated action which resulted in an investigation of the subject of air navigation by the representatives of the following departments: War Department, Navy Department, Treasury Department, Department of State, Department of Agriculture, Department of Commerce, Department of Labor, and also a representative from the National Advisory Committee on Aeronautics, acting as a single committee. Senate bill 4470 and House resolution 14061 as introduced at the last session will serve to bring to the attention of the proper committees of Congress the fundamental considerations which this interdepartmental committee found as being those which must be dealt with in securing a proper solution of the subject.

These facts are cited to prove beyond all doubt that those who direct the Army Air Service have neither attempted to throttle aeronautics nor sought to retain within their authority the control of any aerial activity that was not vitally necessary to the preparedness of the Army for an emergency and to its operations in war.

MAJ.-GEN. CHARLES T. MENOHER, DIRECTOR OF AIR SERVICE
(C) Clindenst, from Underwood & Underwood

Expenditures

Of the $25,000,000 that was appropriated for the last fiscal year, it is significant to note that over eight million dollars were allotted to salaries and expenses of civilian employees. Over two millions were required for the maintenance and operation of stations. About two and a half millions were used for experimental research. Four million dollars covered the production and maintenance of airplanes while a million and a half was spent for the purchase and upkeep of engines and spare parts. The disposal and care taking of surplus material cost two million, three hundred thousand dollars.

Stations and Facilities Acquired by Purchase or Lease

Prior to this fiscal year, land had been acquired for 11 flying fields and 2 supply depots. An aeronautical engine plant at Long Island City and a coast-defense station on Staten Island had also been acquired.

Congress authorized and appropriated sums for the purchase of real estate as follows:

For aviation general supply depot, Richmond, Va., $5,100.

For Ellington Field, Houston, Tex., $40,642.

For Canute Field, Rantoul, Ill., $208,000.

For Park Field, Memphis, Tenn., $88,400.

For Mather Field, Sacramento, Cal., $78,673.

For Chapman Field, Miami, Fla., $71,500.

For March Field, Riverside, Cal., $64,000.

For Brooks Field, San Antonio, Tex., $140,446.

For Kelly Field, No. 2, San Antonio, Tex., $349,686.33.

For purchase of real estate and acquisition of oyster rights at Langley Field, Va., $12,000.

For Scott Field right of way, Belleville, Ill., $100.

For aviation general supply depot, Middletown, Pa., $50,000.

For aviation general supply depot, Little Rock, Ark., $55,000.

For Arcadia Balloon School, Los Angeles, Cal., $55,655.

The Curtiss Elmwood plant at Buffalo was purchased for storage purposes and will be available for production work in an emergency.

Rental charges of over six hundred thousand dollars were in effect at the beginning of the fiscal year but was reduced to slightly over two hundred thousand by the end of the period.

Policy of Army, Navy and Marine Corps Air Services

The policy of the Air Services of the Army, Navy and Marine Corps, as approved by the Secretary of War and by the Secretary of the Navy defines the functions of each service:

Army aircraft.— (Those provided by the War Department and manned by Army personnel.) Operations from bases on shore as an arm of the mobile army; against enemy aircraft in defense of all shore establishments; alone or in cooperation with other arms of the Army or with the Navy, against enemy vessels engaged in attacks on the coast, such as bombardment of the coast, operations preparatory to or of landing troops, operations such as mine laying or attacks in the vicinity of defended ports.

Navy aircraft.—(Those provided by the Navy Department and manned by Navy personnel.) Operations from mobile floating bases or from naval air stations on shore; as an arm of the fleet; for oversea scouting; against enemy establishments on shore when such operations are conducted in cooperation with other types of naval forces or alone when their mission is primarily naval; to protect coastal sea communications by reconnaissance and patrol of coastal sea areas, convoy operations, attack on enemy submarines, aircraft or surface vessels engaged in trade prevention of in passage through the sea area; alone or in cooperation with other arms of the Navy or with the Army against enemy vessels engaged in attacks on the coast.

Marine aircraft.—(Those provided by the Navy Department and manned by Marine Corps personnel.) The functions normally assigned to Army aircraft will be performed by the Marine aircraft when the operations are in connection with an advance base in which operations of the Army are not repre-

sented. When Army and Marine aircraft are cooperating on shore, the control of their operations will be governed by the one hundred and twentieth article of war.

This joint policy contains further provisions intended to prevent duplication of work without unduly restricting essential freedom of action. These provisions are as follows:

All questions regarding the policy of the War and Navy Departments with regard to the tactical and strategical functions of aircraft and to the location of air stations will be addressed to the Joint Board for consideration and recommendation to the Secretary of War and the Secretary of the the Navy.

To prevent duplication and to secure coordination, plans of new projects for the construction of aircraft, for experimental stations, for coastal air stations, and for stations to be used jointly by the Army and Navy, or for extensive additions thereto, will be submitted to the Aeronautical Board for recommendations.

The development of new types of aircraft, or of weapons to be used from aircraft, so far as practicable, will be assigned to and carried on by one air service. This restriction will not prevent the employment by either air service of any types of aircraft or weapons which, after development, are considered to be necessary for the accomplishment of its functions. Questions relating to the development of new types of aircraft or weapons to be used from aircraft will be referred to the Aeronautical Board for recommendation as to which air service shall be charged with the development.

All information pertaining to experiments in connection with aviation will be exchanged promptly between the Army and Navy air services.

Whenever possible, training and other facilities of either air service will be made available for, or be used by, the other service.

Before arranging to purchase aircraft each service will attempt to secure aircraft of the type desired from or through the other service.

All estimates of appropriations for the Army and Navy aviation programs will be presented to the Aeronautical Board for review and recommendation before submission to Congress.

War Expansion—The Problem of the Army Air Service

Consideration of the functions of the Air Service of the Army discloses the fact that in case of war it must undergo an enormous expansion of both equipment and personnel. In the matter of equipment, its problem is such that it can not hope to solve it within itself, but must depend upon the whole manufacturing resources of the Nation; in fact, must depend upon resources not yet established and must lay its plans to the end that such resources shall be established and maintained. The Army must spend its appropriations in experimentation, in limited procurement, and in the test, under field conditions, of experimental productions, in order that it may know what equipment to use when war comes.

Likewise, for its personnel, it is impracticable to seek an expansion of the Army Air Service that would begin to care for its war needs. It must therefore, build its plans upon the annual training and passing into organized reserves of a reservoir of trained flying officers that will be immediately available in case of war; and for its enlisted personnel it must look to the enlisted reserve and to the mechanics engaged in civilian and commercial aeronautics and in aircraft manufactories—sources that are today so small as to be almost negligible.

The vital interest of the Army Air Service lies, therefore, less in obtaining appropriations, more in securing legislation to foster sources of supply of equipment and personnel for the needs that will be so greatly expanded by war.

Militia Organization

The Chief of the Militia Bureau has prepared plans for the training of 16 National Guard units, each of which is to consist of one observation squadron, one balloon company and one photo section. Primary training will take place at home stations and advanced training at Air Service pilot schools.

Air Service Accomplishments

The Advisory Board during the year had much work to do in analyzing the legislation on aeronautics which comes before Congress and in the preparation of estimates for the maintenance of the Air Service.

The Air Serivce Claims Board and the Liquidation Division as well as the Spruce Production Division have been engaged in the settlement of contracts and claims arising from the war contracts.

The Personnel Division in its figures shows that on June 30, 1920, that the commissioned strength of the Air Service consisted of 153 regular army officers, and 1,013 temporary officers or a total of 1,168. There had been during the year 4,185 officers discharged from the service. The Reserve Corps at that time consisted of 5,046 flying officers and 2,293 non-flying officers. The enlisted personnel had dwindled in a year from 21,373 to 8,428. The civilian employes of the Air Service is practically equal to the enlisted strength there being 8,155, mainly at the fields.

The importance of the work of the Information Group is emphasized by the detailed description of its functions and record for the year. The divisions for Collection, Reproduction, Dissemination and Public Cooperation have all carried on their duties in spite of the shortage of personnel.

The Training Division

Here the shortage of properly qualified mechanics as well as pilots has been most serious. The return to civil life of men who could capitalize their experience has brought problems that will become more acute as the Air Service gradually becomes a settled peace-time organization.

The War Department authorized the following Air Service special service schools for aviation training.

Air Service Pilot School, Carlstrom Feld, Arcadia, Fla.

Air Service Pilot School, March Field, Riverside, Calif.

Air Service Pursuit School, Rockwell Field, San Diego, Calif.

Air Service Bombardment School, Ellington Field, Houston, Texas.

Air Serivce Observation School, Post Field, Fort Sill, Okla.

Air Service Communications School, Post Field, Fort Sill, Okla.

Air Service Engineering School, Dayton, Ohio.

Air Service School, Langley Field, Hampton, Va.:

1. Field officers' course.
2. Aerial photography.

Air Service Mechanics School, enlisted men, Kelly Field, San Antonio, Tex.

These have been conducted for training recruits and specialized pilots.

Operations Division

The War Department authorized the organization of two wings and seven groups with stations as follows.

First wing, Kelly Field, San Antonio, Tex.

Second wing, Langley Field, Hampton, Va.

1st day bombardment group, Ellington Field, Houston, Tex.

1st surveillance group, Kelly Field, San Antonio, Tex.

1st pursuit group, Selfridge Field, Mount Clemens, Mich.

1st Army observation group, Park Field, Millington, Tenn.

1st observation group, Philippine Department.

2d observation group, Hawaiian Department.

3d observation group, Panama Canal Department.

The organization of nine photo sections was authorized, also, by this order.

The groups authorized comprise 27 squadrons, divided into 15 observation squadrons, 4 surveillance squadrons, 4 pursuit squadrons, and 4 bombardment squadrons. These squadrons completed their organization and were operating as tactical units in a very short period of time. Lack of trained personnel delayed the organization of the photo sections, but all of them had been organized and were in operation at the close of the year.

As each unit completed its organization, it was placed under the tactical command of the commander of the territorial department to which it belonged.

During the year the 2d and 3d observation squadrons and the 6th photo section comprising the 1st observation group, reported for duty in the Philippine Islands. The 4th and 6th observation squadrons and the 11th photo section, comprising the 2d observation group, reported for duty in the Hawaiian Islands. The 7th observation squadron and the 12th photo

section of the 3d observation group likewise reported in the Canal Zone, but the remaining unit of this group—the 5th observation squadron—has been held at Mitchel Field awaiting the completion of suitable facilities in the Canal Zone for its housing and operation.

The organization of the 1st day bombardment group, the 1st surveillance group, and the 1st pursuit group has been completed, and the headquarters of these organizations designated as Ellington, Kelly and Selfridge Fields, respectively. Ten squadrons have been assigned to compose these groups. The remaining 12 squadrons, of which one is destined for the Canal Zone, have performed varied special duties in the continental United States since their organization.

In the last month of the fiscal year authorization was obtained for the organization of the 258th heavy bombardment squadron. This organization was rapidly effected and the close of the fiscal year finds the first and only heavy bombardment squadron ever contained in the Air Service of the United States on duty at the Aberdeen Proving Grounds.

Balloon and Airship Division

The flying performed by balloon and airship organizations during the fiscal year total over 3,500 hours. This includes approximately 600 hours of free balloon and 275 hours of airship flying. This flying comprised test flights, photographic missions, forest patrol, infantry liaison, and coast artillery observation. These flights also included cross-country trips by airship.

Ten balloon companies have been organized and are now stationed under the command of Army department commanders.

Schools for training officers and cadets as observers were authorized at Ross Field, Cal., and Lee Hall, Va. Two airship schools, one at Langley Field, Va., and one at Brooks Field, Tex., were also authorized.

The helium production plant at Fort Worth, Texas, is practically completed and many developments in the use of this gas may be expected in the next year.

An important accomplishment of the lighter-than-air engineering section is the development of a highly mobile balloon winch. Its principal feature is the use of a single engine with power take-off for operating the windlass. A considerable reduction in weight over existing types is obtained. Another feature is the employment of a light, adaptable caterpillar tread, which is raised when not in use, thus permitting the vehicle to run normally on rubber tire wheels, to which the caterpillar tread can be applied within 20 minutes whenever it is necessary to pass over ground which the wheeled vehicle cannot negotiate.

The fabric department during the past year has made up 148 varieties of experimental balloon fabric, including rubberized, glued, and varnished fabrics, goldbeaters' skins, and doped fabrics. Some excellent samples have been obtained which gave remarkably low permeability tests.

The work on goldbeaters' skin fabric has been especially satisfactory. The production of this fabric is slow and requires painstaking skill, as all the work of laying skins must be done by hand.

Airship Operations

The airship program was seriously handicapped by lack of hangar facilities. At Langley Field, Hampton, Va., a steel hangar, 420 feet long, 100 feet high, and 125 feet wide was sufficiently completed to permit of use on October 20, 1919. The Army airship "A-4" was flown from Akron, Ohio, to Langley Field, and the "Zodiac," the "C-2," and a Mullion airship were erected and put in commission.

The Mullion airship was wrecked by the collapse of a temporary wooden hangar which was being used while awaiting completion of the steel hangar. Three airships are now in commission at the field.

A contract has been closed with the Italian Government for the early delivery of the "T-34," at present the largest semi-rigid airship in the world. This type of ship was found particularly effective during the World War for operations over mountainous country.

One airship station was authorized on the Mexican border at Camp Biernie, Tex., and on November 15 the 8th airship company was transfered from Brooks Field to commence operations. One large airship hangar has been built, also two small airplane hangars, which have been converted into machine shop, electrical shop, aero repair workshop, and stock room.

Noted Flying Contest

General Menoher recounts some of the details of the more important contests and test flights as well as of an Air Service Tournament held during the year.

The New York-Toronto race won by Lieut. Maynard was the first of these contests and it was followed by the great transcontinental reliability and endurance contest. The test demonstrated the potentialities of the Air Service for speedy mobilization, and sustained endurance. The Reserve aviators contest held at Mitchel Field attracted to it many of the ex-service fliers. The first Air Tournament was held at Bolling Field and afforded the public an opportunity to witness some of the progress made by the service during the year.

The Supply Group

While the work of this group is not as susceptiable of description owing to the nature of its functions as others in the Air Service, it is in many ways the most important in the service.

The principal items procured or placed in process of production during the fiscal year were as follows:

Modification of 1,000 DH-4 airplanes into DH-4B's.

3,000 Nelson gun-control drive units for Liberty 12 engines.

559 Bijur electric starters for Liberty engines.

Remodeling of 10 DH-4's to carry six-cylinder Hall-Scott engines.

100 air floats and fins.

300 full-length radiator shutters.

50 Bakelite propellers.

3 JL-6 monoplanes, with spare engines and parts.

400 boster radiators.

Installation of 300-horsepower Hispano-Suiza engines in 48 DH-4 B's.

The procurement of seventy-two 300-horsepower Hispano-Suiza engines, with spare parts.

Disposal and Salvage

The Materials Disposal and Salvage Division in terms of cost to government or appraised values sold or turned over to other branches of the government was over forty million dollars worth of aircraft material. The proceeds from sales amounted to over twelve million dollars which was turned into the Treasury.

Engineering Division

Of the airplanes developed sufficiently to warrant their purchase for service tests, two types were wholly designed and developed, including the building of models for tests, by the Engineering Division.

One of these types is an armored ground attack three-seater triplane, mounting eight machine guns and a 37-millimeter cannon. The two Liberty 12 engines and the crew of this airplane will be protected by armor plate. A contract for 10 of these airplanes was let toward the close of the year.

The other type is a corps observation two-seater previously developed, but perfected during the year by the installation of an interchangeable mount for either a camera or a floor gun. A contract for the production of 40 of this type was closed at the end of the year. The Engineering Division, itself, built the VCP-R airplane the official entry of the United States Government in the Gordon Bennett international cup race. It has also converted a De Haviland 4 airplane into an aerial ambulance by reconstructing the fuselage to carry two Stokes litters behind the pilot.

Close cooperation has been developed between the Engineering Division and manufacturers in the production of new airplanes and equipment. Anyone may submit designs for engines, airplanes and their accessories, and if they show promise of military value they will be given exhaustive tests, their weakness pointed out, and the required changes suggested, so that they may be incorporated in the next models.

The suggestions made to the manufacturers as a result of these tests and the technical data regularly furnished them in weekly, bi-monthly, and special reports regarding tests conducted by the Engineering Division have resulted in the development by aircraft manufacturers of several types of airplanes needed by the Air Service.

In addition to the types described above, which were designed by the Engineering Division, contracts have been closed for the production of 50 each of two types of combat-pursuit single-seater airplanes and for 20 short-distance night bombardment airplanes, which were brought to states of development and warranted orders for production through the cooperation of the Engineering Division with their designers.

Aircraft manufacturers are freely furnished with technical data other than that which is of a secret or confidential nature. Likewise, technical information compiled by the Engineering Division is distributed to other interested parties as well as to aircraft manufacturers, through the activities of the Information Group, which is charged with the proper distribution of such data.

Forest Patrol

The Forest Patrol has had a wider field of operation and is being continually enlarged. Congress declined to grant the increased personnel sought, and at the close of this fiscal year only one squadron was engaged in patrol of the forest areas. However, plans are being drawn up to bring reserve personnel into active service and form the required organizations.

Retention of McCook Field

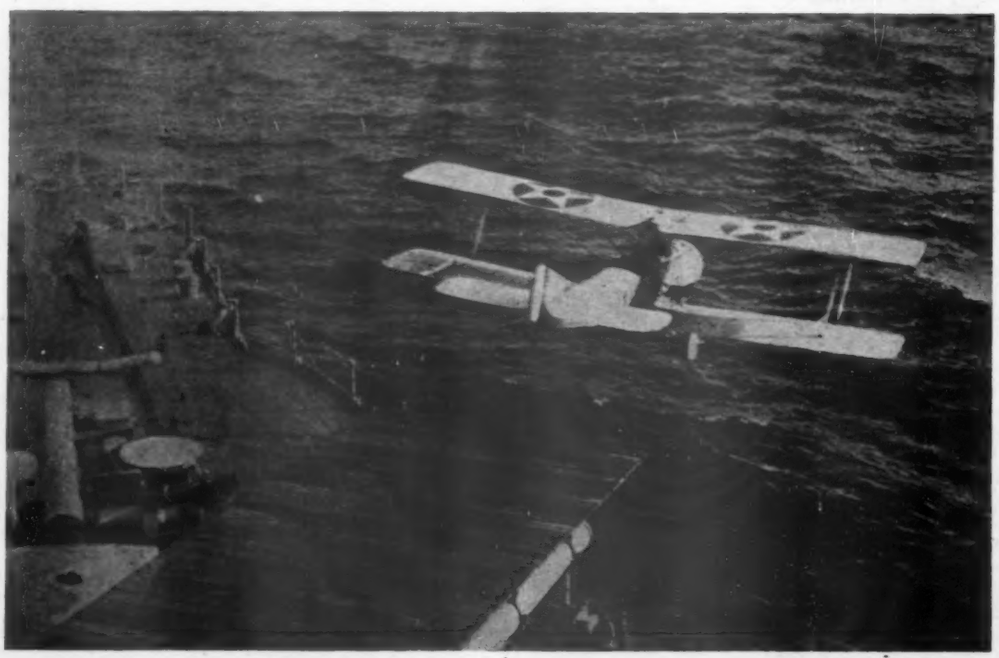
The Air Service has failed in its endeavors to secure from congress an appropriation to provide a home for its Engineering Division. This division is now located at McCook Field, Dayton, Ohio. The owners of this property have notified the Air Service that its lease will not be extended beyond December, 1921. A suitable location for the home of the Engineering Division was offered the Air Service by the Dayton Wright Airplane Co., at a price which the Air Service representatives considered very reasonable. This proposition was submitted to Congress, but permission for the consummation of the project was refused.

The Air Serivce has been unable to date to find a suitable location for the Engineering Division on goverenment-owned land. The search for a location will be continued, but it is hardy believed that the government now owns land which will be suitable for a plant of this kind. Considerable time will be required to transport the machinery and equipment from McCook Field, and at an estimated cost of one-half million dollars. At any rate, it is now clear that at its next session Congress must take the necessary legislative action for this primary and most important requirement of the Air Service.

Construction of Airship Stations on the Border

During the past year a program for the erection of six border airship stations was prepared by the Air Service. Approval was secured for the erection of one station at El Paso, Tex. It was understood that the results obtained in operations from this station would determine the merits of the project. Difficulties and delays in securing labor and materials prevented the completion of the hangar necessary for housing this airship until the close of this fiscal year.

An airship will be placed in operation from this station early in the coming fiscal year and will be used in the patrol of the border, covering a radius of approximately 200 miles in each direction. This airship will also be used for training purposes in cooperation with other arms in the border districts. The Air Service believes that this patrol will prove successful and will demonstrate its claims that an airship can carry on patrol work of this nature more satisfactorily than foot or mounted troops and with much less expense.



SHIP'S PLANE TAKING OFF FROM THE U. S. S. PENNSYLVANIA

Photo International

National Advisory Committee Report for 1920

The sixth annual report of the National Advisory Committee for Aeronautics was submitted to the President by Dr. Charles D. Wolcott, chairman, and transmitted to Congress by the President with the comment:

"The national aviation policy as formulated by the National Advisory Committee for Aeronautics and the constructive recommendations therein set forth for the consideration of the Congress have the hearty approval of the departments concerned as well as myself."

Parts of the report of general interest follow:

Organization of Governmental Activities in Aeronautics

During the past year the committee has on numerous occasions given consideration to the subject of organization of governmental activities in aeronautics. A number of bills have been introduced in Congress providing widely differing solutions of the question, and each of these bills was discussed by the committee. After the adjournment of Congress and throughout the summer and fall of 1920 the committee endeavored to coordinate the views of the various governmental agencies interested, and to develop a tentative draft of legislation giving definite expression to the agreements reached. In its consideration of each of the measures introduced the committee was guided by an intimate knowledge of the problems peculiar to the military and naval air services, by the necessity of providing for, and reckoning with, a healthy development of civil aviation, and by broad general considerations of sound governemental policy in regard to matters of organization and administration. Of all the bills analyzed by the committee, two were selected for more earnest consideration, and in each case this has led to agreement upon amendments, which will in the committee's judgment, render either measure, if enacted into law, operative with a minimum of friction, confusion, or waste, at the same time utilizing existing agencies to the best interests of good administration. An analysis of the two bills referred to, as modified by the committee, follows:

House bill 14061 was introduced into the House of Representatives by Mr. Kahn, May 13, 1920. With the modifications recommended by the National Advisory Committee for Aeronautics, it provides for the establishment of a Bureau of Aeronautics in the Department of Commerce, in charge of a Commissioner of Air Navigation whose duties will comprise the licensing of aircraft, pilots, and airdromes, the designation of flying routes, cooperation with the states and municipalities in the laying out of landing fields, and, in general, the promotion of all matters looking to the advancement of commercial aviation. The bill provides also that all rules and regulations governing air navigation, licenses, etc., shall be formulated by the Commissioner of Air Navigation, who shall submit the same to the National Advisory Committee for Aeronautics for consideration, criticism, and recommendation to the Secretary of Commerce, who, if the same meet with his approval, shall formally promulgate the same. The bill provides further that the Commissioner of Air Navigation shall be appointed a member of the National Advisory Committee for Aeronautics, and shall seek the approval of the committee in certain matters, such as the laying out of flying routes, etc., which may hold a vital interest for other departments of the government. The committee believes that all such extensive plans should be carefully considered with a view to serving the national interests as far as possible; that the Commissioner of Air Navigation should have the benefit of the counsel and advice of the other governmental agencies concerned; and that the method proposed in this bill would be practicable and effective.

House bill 14137 was introduced in the House of Representatives by Mr. Hicks, May 19, 1920. With the modifications recommended by the National Advisory Committee for Aeronautics, it makes substantially the same provisions for the regulation and development of air navigation as the modified bill, H. R. 14061, described above, with several additions, viz.: That the various departments of the government shall prepare programs for experimental research or development work in aeronautics, and for the purchase or construction of aircraft, engines, accessories, and hangars, and the acquisition of land for purposes in connection with aviation, and shall submit such programs to the National Advisory Committee for Aeronautics for consideration and recommendation before contracts are made or orders are placed for same; that for the purpose of preliminary correlation of estimates the various departments shall submit their estimates for all aviation purposes to the National Advisory Committee for Aeronautics for consideration and recommendation by the committee before the estimates are submitted to Congress, the comments and recommendations of the Advisory Committee to be transmitted to Congress along with the estimates.

The committee has been actuated in its suggested revision of these bills by a desire to produce practicable workable plans for improving the existing situation. The committee believes that the Hicks bill as modified is responsive to that sentiment in Congress which has sought to prevent duplication of expenditures and effort in the military and naval air services. The committee is not wholly convinced that the necessity for such legislation exists at the present time, nor that the method proposed would have the desired result. On the other hand, the committee is unanimous in supporting the Kahn bill as modified. The most urgent need at this time is the development of commercial aviation under Federal regulation. There has been some objection to placing the regulation of air navigation under the Department of Commerce, but the National Advisory Committee for Aeronautics believes it unnecessary and unwise to create another independent Government establishment for the exercise of such functions, and that by making the Commissioner of Air Navigation a member of the National Advisory Committee for Aeronautics, and requiring him to submit his plans to the committee, he can not fail to be guided in his actions by considerations of paramount national interests.

Canada's Courtesy Regarding American Air Pilots

In June, 1920, the committee received through the State Department information to the effect that the Canadian Air Board had promulgated regulations permitting United States qualified aircraft and pilots to fly in Canada until November 1, 1920, on the same basis as if the United States had established air regulations as contemplated under the Convention for the Regulation of International Air Navigation. The committee, by resolution adopted at the July meeting, recommended that the State Department express the appreciation of the Government of the United States for the courtesy of the Canadian Government in this matter, and in view of the fact that the Congress of the United States was not then in session and would not meet until December, 1920, further recommended that the State Department inquire if the Canadian Government would be willing to extend by six months from November 1, 1920, the period during which United States pilots and aircraft would be permitted to fly in Canada under the existing conditions. The State Department acted upon these recommendations, and as a result the Canadian Government has extended its courtesies to American pilots and aircraft until June 1, 1921. The entire incident, however, serves to emphasize the need for Federal legislation for the regulation of air navigation as recommended in another part of this report.

A National Aviation Policy

Aviation activities during the war were concentrated on the development and production of military aircraft. The selection of the landing fields that were established was necessarily guided by military considerations. The close of the war found us with an aeronautic industry at the stage of quantity production, a large amount of aircraft material on hand, a large number of trained fliers, and a few scattered landing fields. In brief, all this constituted the national inheritance from the investment of hundreds of millions of dollars for the hurried development of military aviation during the war. In the two years that have elapsed since the armistice a good proportion of the aircraft material has become obsolete. A majority of the technical personnel and trained fliers have returned to civil life and to pursuits not connected with aviation. The great aircraft industry has almost disappeared, and some of the landing fields have been surrendered. Those that have been

retained really represent one of the most valuable physical assets salvaged from our aircraft expenditures.

As a nation we must seek to realize clearly the lessons of the war and to profit by them. Our efforts in the development of a military air force and the organization of an aircraft industry during the war were remarkable accomplishments in themselves, but the handicap of a negligible industry at the outbreak of the war and the general lack of technical knowledge were too great to be satisfactorily overcome in a short time, regardless of the money available. It is now our clear duty to take to heart the lessons and mistakes of the war period and to shape a national aviation policy that will be productive of the greatest possible structural development consistent with prudent economy.

The government agencies actively concerned with the use of aviation at the present time are the Army Air Service, the Naval Air Service, and the Postal Air Service. Other agencies such as the Geological Survey, the Coast and Geodetic Survey, the Forest Service, etc., have more or less need for the use of aircraft in their work. The National Advisory Committee for Aeronautics is concerned not so much with the promotion of the uses of aviation as with the scientific study of the problems involved and the technical development of the art for the benefit of governmental agencies and of the public generally, but the committee believes that the use of aircraft by the various governmental agencies should be encouraged where its efficient use is practicable; also that the general development of aviation for all purposes should be encouraged by the national government. The faithful performance of our national duties in these respects becomes compelling from considerations of wise military preparedness.

In time of war aviation will probably be the first arm of offense and defense to come into action. For this there must be an established industry and a trained and active air service. Aerial supremacy at the outset of hostilities would be a tremendous military advantage. Ultimate victory would unquestionably incline to the side that could establish and maintain supremacy in the air. Huge expenditures of money in time of danger and frantic efforts to train personnel and to develop hastily an aircraft industry from almost nothing will not do. There must be wise preparedness; there must be in healthy existence at least a nucleus of an industry capable of adequate expansion; there must exist civil and commercial aeronautical activities in all parts of the country which would be the main support of the industry in time of peace.

In pure self-defense the government must encourage the development of commercial aviation. The alternative proposition is the creation and maintenance of a powerful standing military air service relatively self-reliant in time of war. We can not, however, afford the expense which such a policy would entail, and there would be no advantage in time of peace from such expenditures comparable in any way to the advantages to be gained from the support of civil aviation.

We should maintain an active air service in time of peace, which should possess inherent strength and be something more than a mere nucleus for expansion in time of war. In the final analysis, however, we must depend upon civil aviation to furnish a military reserve force. The remarkable accomplishments of our Motor Transport Service during the war were only made possible by the healthy condition of our automobile industry. The problem is to place our aircraft industry in a healthy condition, and to do this we must enter without delay upon a sane, sound policy for the development of civil aviation. The relative cost of fostering an organized plan to develop commercial aviation would be much less than the waste that would inevitably result from unprepared entry into war. Aside from military considerations, the fostering of commerical aviation would in time yield adequate returns in itself in the form of promoting and strengthening our means of transportation, advancing the progress of civilization, and increasing the national wealth.

Aviation is a distinct advance in civilization given to the world by America. The importance of the development of aviation from a military standpoint was not fully appreciated before the war, with the consequent lack of encouragement of the development of the art. The handicap of years of comparative inactivity has not yet been overcome. We can not afford to repeat the mistakes of the past. We can not go backward, but must go forward with the intelligent development of aviation in all its branches.

Aviation is still in its infancy; its possibilities, while unknown, appeal to the imagination. The forced development during the war and some of the experimental development since have not been based upon scientific research and sound scientific principles that make for substantial progress. Technical training is necessary, including education in advanced aeronautical engineering, so is the actual training of a large body of men in the technique of the care and operation of aircraft. Broadly speaking, scientific research, technical training, and commercial aviation constitute, or should constitute, the backbone of a national policy.

Reducing to definite form the steps which in the opinion of the National Advisory Committee for Aeronautics are wise and timely, the committee, after careful consideration of all the facts within its knowledge, submits the following specific recommendations:

First. That legislation be enacted providing for Federal regulation of commercial air navigation, licensing pilots, aircraft, landing fields, etc. At the present time there is no authority of law for any executive agency of the Government to perform such duties. The committee believes that for the executive administration of these new duties of government there should be established in the Department of Commerce a bureau of aeronautics in charge of a Commissioner of Air Navigation, who should also become a member of the National Advisory Committee for Aeronautics. In this connection the committee recommends also the adoption of a policy of federal aid to the states in the establishment of landing fields for general use in every state in the Union.

Second. That the Congress authorize an American airplane competition in order to stimulate private endeavor in the development of new and improved designs of aircraft, the competition to be under the direction of the National Advisory Committee for Aeronautics, the entries of the successful competitors to be purchased by the government at a predetermined and announced figure and made available for the use of the Postal Air Service.

Third. That adequate appropriations be made for the military and naval air services in order to permit the continuous development of these exceedingly important arms of the two services, and to enable them to place orders in such a way as to maintain a nucleus of an aircraft industry capable of sufficient expansion to meet military needs in time of emergency. The committee considers this absolutely essential.

Fourth. That the control of naval activities in aeronautics be centralized under a naval Bureau of Aeronautics in charge of a Director of Naval Aviation. At the present time responsibility for the development of naval aviation is divided between the Office of Operations and the numerous bureaus of the Navy Department. This basis of organization does not permit full cooperation with the Army Air Service or with other governmental and civil agencies, nor does it, in the opinion of the committee, promote the efficient development of aviation within the Navy.

Fifth. That the Air Mail Service of the Post Office Department be further extended and developed. This service has given the best demonstration of the practicability of the use of aircraft for civil purposes. It his been seriously handicapped by inability to secure suitable airplanes adapted to its work. The question is one of design, which should be handled by the industry. The remedy lies in the development of the industry, which can only be brought about at an early date by the indorsement and prosecution by the government of a constructive, comprehensive policy.

Sixth. That the Congress approve the program of scientific research in aeronautics formulated by the committee and provide for the enlarged facilities necessary for its prosecution.

The report gives a summary of the research work done by the various technical sub-committees on Aerodynamics, Power Plants for Aircraft and Materials for Aircraft. It reviews the work done at the Langley Memorial Aeronautical Laboratory and lists the numerous technical reports which have been issued.

The appropriation for the year was $175,000 and the committee asks for next year $489,906 to be used as follows:

Reports and intelligence work, $59,800; Washington office, $24,540; power plant research, $131,600; aerodynamical research, $215,000; Langley Memorial Aeronautical Laboratory, $58,666.

A Railway for Testing Full Size Airplanes*

In Figs. 1 and 2 is shown a tower, placed on a modification of a railway truck, which is pulled along by a locomotive. On top of the tower is placed the full size airplane to be tested. The airplane is connected to the tower in such a manner that a variety of indicating apparatus is brought into play. By means of this apparatus forces can be measured both in magnitude and direction just as in a wind-tunnel.

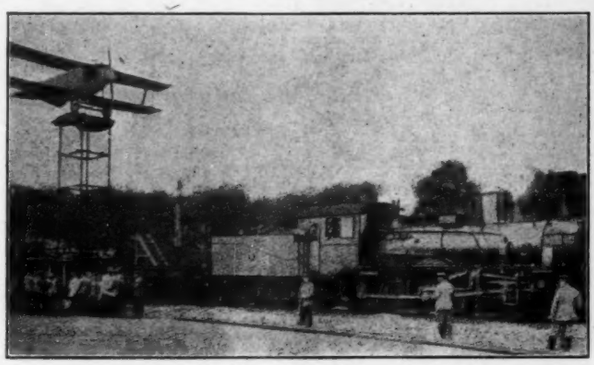


FIG. 1

The main difference between the wind-tunnel and the airplane testing railway is that in the railway scale effect is eliminated. Also certain flight conditions can be studied which it is impossible or difficult to reproduce in the tunnel, and which it is dangerous to study in the air. Further, the effect of such parts of the airplane as body, chassis, trussing, radiator, airscrew with motor in action or at rest can be studied more exactly than in a wind tunnel model. The effects of change of wing surfaces under load and other deformations under load are also brought into play.

In the construction and use of such a testing equipment, practical difficulties regarding road-bed and so forth are many, but are not insuperable. In the construction of the road-bed special features have to be introduced, if the very highest locomotive speeds are to be used safely and without undue disturbance.

Disturbances and oscillations due to the road-bed and to the violent movement of the locomotive can never be completely avoided, and this has an important bearing on the design of the measuring instruments. It seems impossible to balance the mass of the airplane to be tested in relation to the points of rotation in the measuring system,—so as to avoid effects of acceleration—because this introduces too great a complication and weight into the apparatus.

The correct method of attack regarding the measuring instruments is to provide thorough damping. The regulated measuring apparatus shown in Fig. 3 has shown itself to be the only practicable type, because it is the only arrangement which introduces no moving parts and nevertheless allows the use of powerful indicating or recording instruments. This is in strong contrast to the unregulated piston type or membrane type instruments which can only be used with Bourdon indicating mechanisms allowing only small changes in volume and a small range of measurement. The regulated measuring apparatus is distinct from the simple piston or membrane types in having the oil under pressure not completely shut off, and being self-regulating, so that its piston is maintained in its correct position independently of oscillation. By regulating at will the size of the oil inlet and outlet a very strong and regular damping can be obtained. By the use of this damping all the oscillations and disturbances on the specially prepared railway were overcome.

A short description now follows of the complete system necessary for the measurement of the air forces acting on the plane in magnitude direction and position:

Fig. 4 shows in diagrammatic form the arrangement of the six measuring instruments on the floating framework, which hung on the head of the tower, constitutes the carrier of the plane to be experimented on. Fig. 5 indicates the same arrangement in more mechanical form.

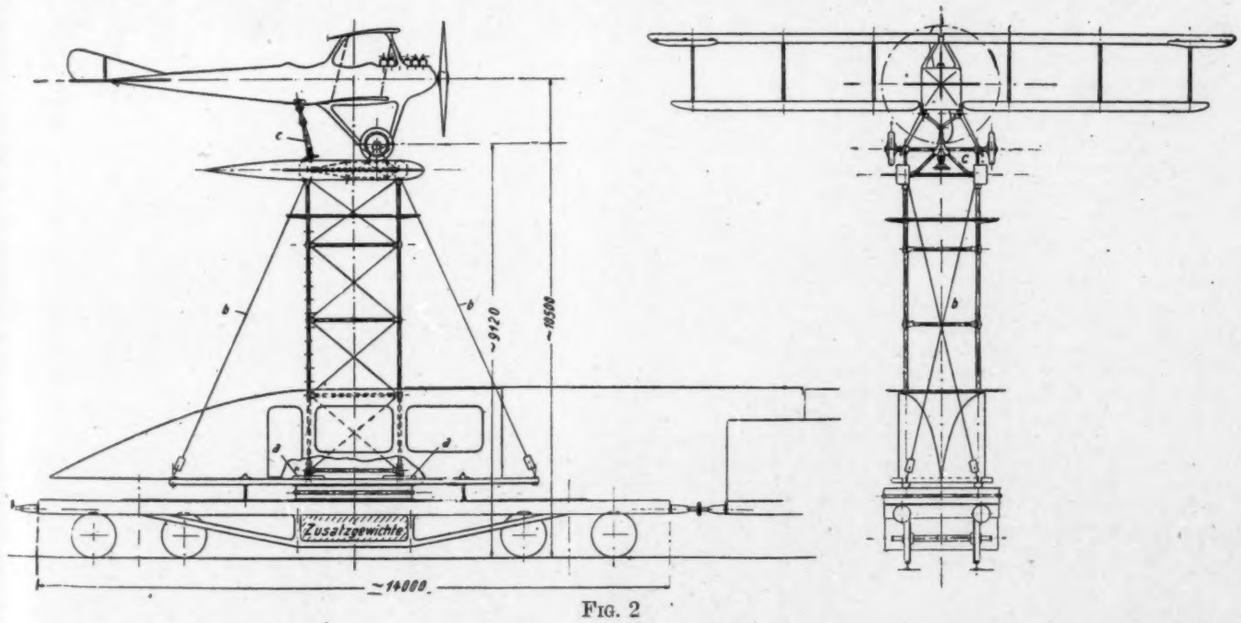


FIG. 2

As the forces to be measured at these six points may act either as a push or a pull, and as each of the measuring boxes can only indicate a push, there must be provided at each of the six points, opposition under constant pressure which so acts on the piston of the measuring box as to give it a positive downward force, even when a strong pull is present instead of a push. The arrangement is indicated clearly in Fig. 6. The oil for the measuring box is taken from an oil flask under pressure which is fixed on the car. In similar fashion the oil for the opposition piston is taken from an oil container which

*Abstract of a paper by Dr. Bendemann before the German Aeronautical Society.

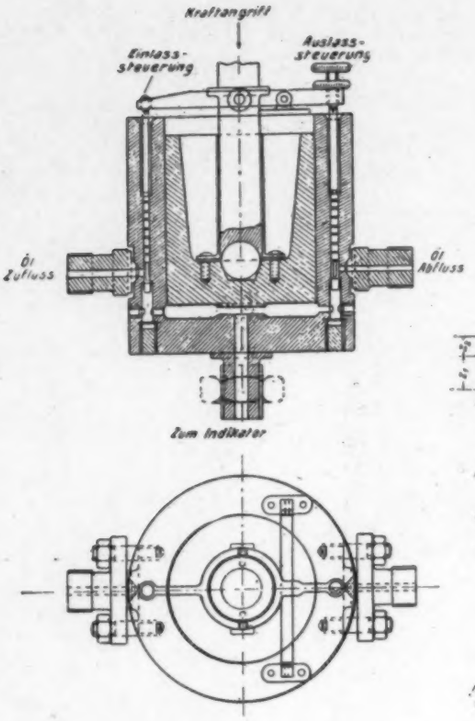


FIG. 3

Kraftangriff: Application of force to be measured.
Einlasssteuerung: Inlet regulation.
Auslasssteuerung: Outlet regulation.
Oel Zufluss: Oil inlet.
Oel Abfluss: Oil outlet.
Zum Indikator: To the indicator.

is connected to a very large volume of oil under pressure. A very careful regulating system is introduced so that even during lengthy experiments the effort of the opposition piston remains perfectly constant.

The six indicators which register in accordance with the six measuring boxes are built in a special chamber embodied in the lower part of the tower. The indicators register on a common drum moved by powerful clockwork. The registrations are so arranged that simultaneous markings are on the same vertical line of the drum. This is obtained by having the indicators write on a line perpendicular and not parallel to the axis of the indicating cylinder, as shown in Fig. 6.

Besides these six indicators, three other instruments show on the same drum the speed of the carriage wheels, the acceleration in the direction of motion and the wind pressure on a pressure tube placed in the direction of motion. Two electrical indicators give time elapsed and distances traveled as a check.

This recording apparatus is contained in an observation chamber placed at the foot of the tower, where the air-pressure and oil-pressure containers were also placed. The tower itself

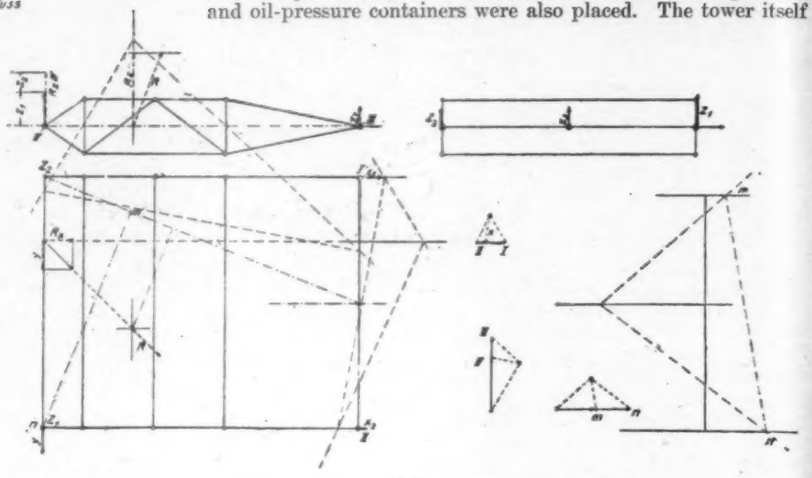


FIG. 4

is a structure of steel tubing with diagonal bracing of airplane cable resting on shock absorbers of carriage springs to avoid the transmission of vibrations from the carriage to the tower. The whole was placed on a cross turn table so that measurements could be taken in two directions without turning the carriage. The turn table can also be used to counteract the effects of a side wind.

The whole somewhat complicated measuring system has proved satisfactory. Considerations of an aerodynamic character were also satisfactorily met. Laboratory experiments

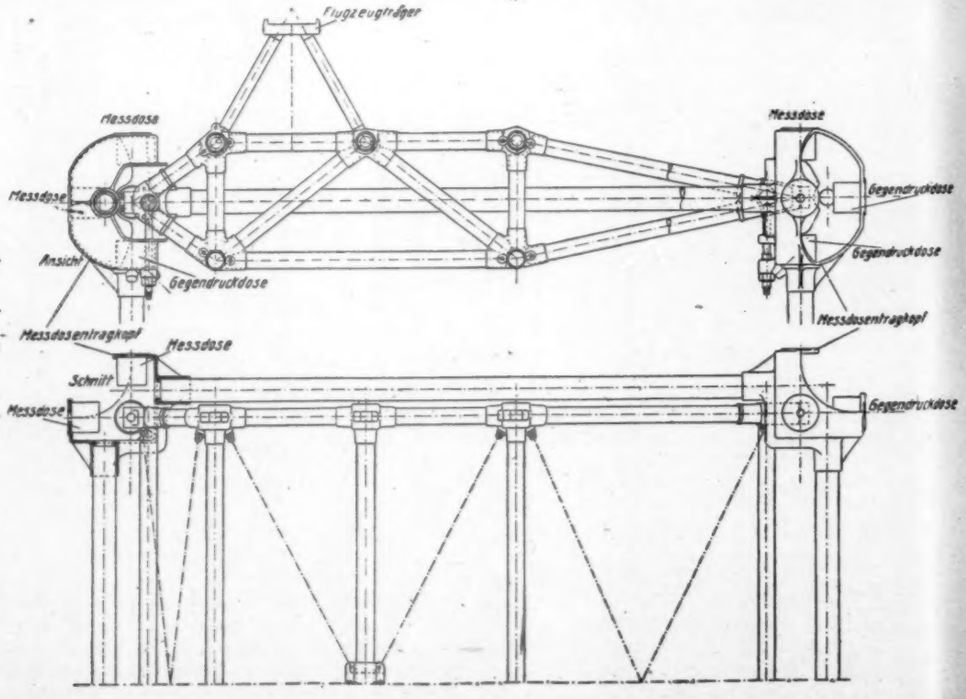


FIG. 5

Messdose: Regulated measuring apparatus.
Flugzeugtraeger: Carrier for the airplane
Gegendruckdose: Opposition piston apparatus.
Messdosentragkopf: Head for carrying regulated measuring apparatus.

on models of the installation indicated that with a tower 10 meters high, with the wings placed in rear of the locomotive, no air disturbances were to be feared.

The conclusion of the war and the use of ordinary railroad

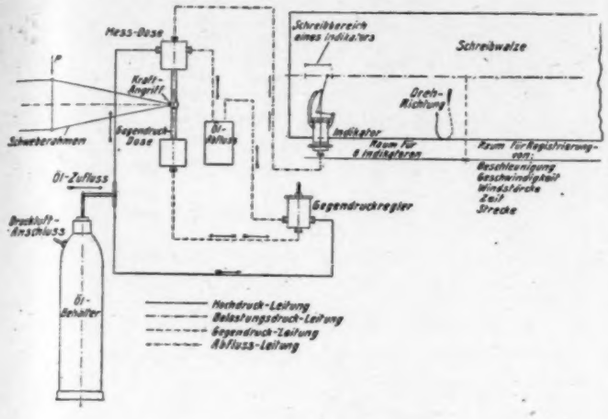


FIG. 6

Mess-Dose: Regulated measuring apparatus.
Kraftangriff: Application of force to be measured.
Gegendruckdose: Opposition piston apparatus.
Schwebe rahmen: Floating frame.
Oee-Abfluss: Oil outflow.
Oee-Zufluss: Oil inlet.
Druckluft-Auschluss: Air pressure connection.
Oee-Behaelter: Oil container.
Schreibwalze: Indicating drum.
Drehrichtung: Direction of motion.
Gegendruckregler: Opposition pressure regulator.
Indikator: Indicator.
Schreibbereich eines Indicators: Marking range of an indicator.
Raum fuer 6 Indikatoren: Room for six indicators.
Raum fuer Registrierung von: Room for registering.
Beschleunigung: Acceleration.
Geschwindigkeit: Speed.
Zeit: Time.
Strecke: Distance.
Hochdruck-Leitung: High pressure connection.
Belastungsdruck-Leitung: Load pressure connection.
Gegendruck-Leitung: Opposition piston connection.
Obfluss-Leitung: Outlet connection.

equipment prevented any actual aerodynamic experimentation being completed, but a very interesting subsidiary of the work was brought to completion in the fast moving driving carriage

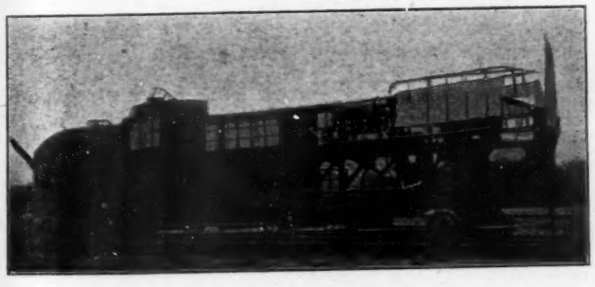


FIG. 7

shown in Fig. 7 which is equipped with 240 hp. Mayback motor driving an air-propeller. A rear propeller drives a smaller screw for rearward motion.

Our Naval Air Detachment in England

The detachment of 15 officers and 45 men are now at Howden, England, and their course includes the care, maintenance and operation of rigid airships.

The detachment has been stationed at various times at the Royal Airship Works, Bedford, where our great airship the ZR-2 is building. At Bedford the construction of the huge airship was started and short courses taken in fabric, and duralumin metal working.

The engineering section of the Detachment has received instruction at the Sunbeam Motor Works at Wolverhampton where the ZR-2 engines are being built. A course was taken there in the manufacture, repair and operation of this type of engine.

The detachment has also visited the Royal Airship Station at Pulham where the two German Zeppelins, the L-64 and L-71, turned over to the British in accordance with the Versailles treaty, are housed. Much valuable information was gained in studying these huge ships.

Practical flight instruction has for the most part been made in the R-32, the British training airship. This ship has been for the past several weeks entirely handled by U. S. Navy personnel. All workmanship, including care, and upkeep devolves upon them and during flights they have entire charge of the great ship.

When the ZR-2 is launched early in the year our Naval Air Detachment will be entirely competent to take charge of her during her trials and bring her safely to America after acceptance by our engineering experts, Comdr. H. T. Dyer, USN, now at the Bedford Royal Airship Works, Comdr. L. H. Maxfield, USN., Lieut.-Comdrs. V. N. Bieg and E. W. Coil, USN. The commissioned personnel in England in connection with this Detachment are as follows:

Comdr. L. H. Maxfield, USN., commanding officer, Comdr. H. T. Dyer, USN., Lieut.-Comdr. V. N. Bieg, USN., Lieut.-Comdr. E. W. Coil, USN., Lieut. F. P. Culbert, USN., Lieut. H. W. Hoyt, USN., Lieut. R. W. Pennoyer, USN., Lieut. C. G. Little, USNRF., Lieut. T. B. Null, USNRF., Lieut. J. B. Lawrence, USNRF., Lieut. A. R. Houghton, USNRF., Lieut. M. H. Esterley, USNRF., Lieut. W. R. Taylor, (MC) USN., Lieut. J. H. Kyger, (SC) USN., Ensign J. H. Hykes, USN., Ensign W. J. Medusky, USN., and Ch. Mach. S. S. Halliburton, USN.

Efficiency of Small Bearings in Instruments

"The Efficiency of Small Bearings in Instruments of the Type Used in Aircraft" is the title of Report No. 94 of the National Advisory Committee for Aeronautics. It deals with the construction and properties of bearings and pivots for use in instruments. The static and running friction for both thrust and radial loads was determined for a number of conical pivots and cylindrical and ball bearings. The static rocking friction was also measured for several conical and ball bearings under a heavy load, especially to determine their suitability for use in an N. P. L. type wind tunnel balance.

In constructing conical pivots and sockets it was found that the pivots should be hardened and highly polished, preferably with a revolving lap, and that the sockets should be made by punching with a hardened and polished punch. It was found that for a light load the conical pivots give less friction than any other type and their wearing qualities when hardened are excellent. When the load exceeds about 1000 g. ball bearings give less friction than pivots and will stand shocks and wear better. Very small ball bearings are unsatisfactory because the proportional accuracy of the balls and races is not high enough to insure smooth running.

For rocking pivots under heavy loads it was found that a ball and socket bearing, consisting of a hemispherical socket and a sphere of smaller diameter concentric with it with a row of small balls resting between the two was superior to a pivot resting in a socket. It was found that vibration such as occurs in an airplane will greatly reduce the static friction of a pivot or bearing, in some cases to as little as one-twentieth of its static value.

Aerial Photography Around New York

The New York *Evening Post* at the suggestion of its real estate editor has recently been publishing a series of aerial photographs taken by the Fairchild Aerial Camera Co. Some of the captions have invited the readers to attempt to find their own homes in the picture. A series of pictures were also taken for the *Bronx Home News* showing living conditions and transit facilities in that borough. There seems to be no doubt that aerial photography will be used to a great extent in the real estate business in the future as features can be shown as clearly in no other way.

The Effect of Elevator Weight

By F. H. Norton

The weight of the elveators may be a very important factor in the performance of an airplane, but very little thought has been given, in the past, to this problem. It is the purpose of the present paper, to consider in detail the effect on stability and controlability of the elevator weight.

That there is a considerable variation in this weight, even on similar machines, is evidenced by comparing two training planes of about the same size, the JN-4 and the VE-7. On the former machine a force on the stick of 8½ lb. is required to hold the flippers up when the machine is at rest on the ground, while on the latter machine a force of about 2½ lbs. is sufficient.

A pilot considers a machine nose heavy when there is a pull on the stick in flight. The cause of this nose heaviness however, may be due to a number of qualities of the airplane, the center of gravity too far forward, the stabilizer at too large a positive angle, or the elevators may be too heavy.

Suppose a certain new machine is calculated to be balanced from wind-tunnel tests, but when flown is found to have an excessive pull on the stick due to heavy elevators. The machine is reported nose heavy and the center of gravity is moved back to correct it, with the result that an originally stable machine is made unstable.

It is possible to determine quite closely the necessary movement of the center of gravity to balance a given increase in elevator weight. Let us assume initially that the machine is balanced with no load on the tail, and weightless elevators are at zero angle to the stabilizer.

M_1 = moment of tail load about C.G. of the machine.
M_2 = moment of tail load about hinge of elevator.
A = area of tail
l = distance from C.P. of tail to C.G.
V = air velocity over tail
O = angle of elevator to stabilizer.
k = constant
c = chord of elevator

Then: $M_1 = k_1 AlV^2\theta$ for values of θ below 10 deg. and $M_2 = k_2 cV^2\theta$. Therefore, $\frac{M_1}{M_2} = k\frac{Al}{c}$

From wind-tunnel tests on model tail planes (R & M No. 250 British Advisory Committee) it is found that when the depth of the elevator is 0.4 of the total chord of the tail-plane the ratio $\frac{M_1}{M_2}$ is nearly constant and for an ordinary machine will have the value 16.

Then $\frac{16M_2}{W} = \Delta l$, where W is the weight of the machine and Δl is the change in C.G. position.

For example, suppose M_2 which was initially assumed zero be increased to 16 pounds feet, and if the weight of the complete machine is 2100 lb., the change in C.G. position necessary to balance the machine would evidently be .12 ft. or 1½ in. It is a fact not often recognized that balancing elevators, not only balances them aerodynamically but also statically and the latter may have as much effect on the performance as the former.

The elevator weight can also be balanced by hanging a weight on the control stick by means of a pulley and wire. A spring or elastic will not however truly balance them, as in accelerated flight the apparent weights of all objects on the machine increase, while the tension of the spring remains constant. The first advantage, then, of a light or balanced elevator is that it allows a forward position of the center of gravity. Since there is no diving moment due to the free elevator and this in turn increases the machine's longitudinal stability.

As the apparent weight of the elevator is proportional to the acceleration acting on the machine, it is evident that during a stunt, the pull on the stick will be:

$f = (a-1)\ f_1 + f_2$,

where f is the pull on the stick.

a is the acceleration in terms of g.

f_1 is the force on the stick due to the static weight of the elevator.

f_2 is the normal force on the stick including air force and static weight.

Take for example, the JN-4 where f_1 is 8½ lb. and f_2 is 10 lb., when performing a loop in which the acceleration reaches $3g$, a force is produced on the stick of 27 lb. This force is however to some extent counteracted by the angular

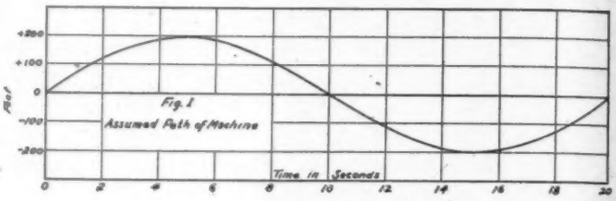


FIG. 1

acceleration in pitch, but as will be shown later this effect is comparatively small. A pilot when changing from a machine with heavy elevators to one with light elevators would have a tendency to pull the latter machine around faster, thus giving it a higher loading, because a flier judges his stresses a good deal by the force on the stick.

It might seem probable that the effect of heavy elevators would be considerable on the maneuverability of the machine due to the greater force required to pull back the elevators in a given time. From experiments made to determine the rapidity of pulling back the control column under various loads, it was concluded that the time was practically the same from no load to the maximum that could be pulled. (R & M No. 282 British Advisory Committee). The heavy elevators however do increase the work the pilot must accomplish and they put more stress in the control wires, so that light elevators are of considerable value in this respect.

Perhaps the most interesting effect of elevator weight is on the character of the free oscillations. Let us consider a machine with weightless elevators traveling with free controls along a sinusoidal path as in Fig. 1. It is known that the true motion of an airplane is not a true sine curve but it does not depart far from it, and for convenience in the mathematical analysis this assumption is essential. It is also assumed that the velocity of the machine is constant along the path and that the amplitude of the oscilations is constant.

Let the curve be represented by:—

$y = b \sin Kt$.

Then the acceleration at any point on the curve will be:

$$a = \frac{d^2y}{dt^2} = -K^2 b \sin Kt,$$

which is also a sine curve with 180 deg. lag. This curve is plotted in Fig. 2 and shows that a negative acceleration is present at the tops of the oscilations, and a positive acceleration at the bottoms. These curves and also Fig. 1 are drawn to represent a total length of oscilation of 200 ft. in 20 sec. and a distance of 400 ft. between crest and trough.

As the slope of the curve at any point is given by:

$$\frac{dy}{dt} = Ka \cos Kt$$

the angular acceleration at any point will be:

$$\frac{d^2y}{dt^2} = K^2 a \cos Kt$$

This is assuming that the airplane always remains parallel to its path.

A curve of angular accelerations is plotted in Fig. 2 for an elevator having the usual position relative to the center of gravity of the airplane. It is seen that this curve is a sine curve lagging 90 deg. from the path, but its magnitude is very small. A curve is also plotted in Fig. 2 of the combined

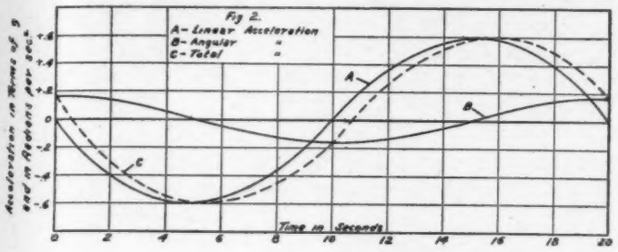


FIG. 2

accelerations, which is very little different from that of the curve of linear accelerations. This final curve is proportional to the moment exerted on the free elevator.

In the preceeding discussion it was assumed that the speed of the airplane was constant, but as the velocity along the path is greater in the trough than on the crests the effect would simply be to move the whole acceleration curve downward. For oscilations of small amplitude, however, this change is very slight and may be neglected safely.

Now that the force acting on the elevator is obtained, it is evident that the pitching moment of the machine will be proportional to it. In general, it is impossible to obtain an exact equation of the resulting path, but for a particular case the path may be determined by rather laborious step by step intergration.

As the accelerating force tends to dive the machine with heavy elevators on the upper half of the path, and to pull it up on the lower half it is clear that the amplitude and period will both be reduced so that the equation of the new path will be:

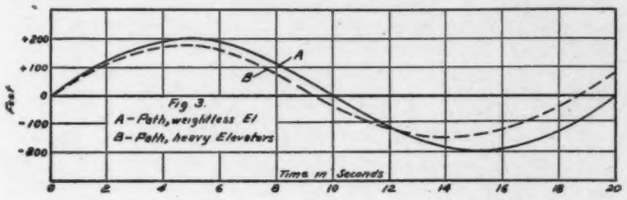


FIG. 3

$$y = ae^{-mt} \sin K_1 t$$

where m is the damping factor, the magnitude of which is proportional to the elevator weight. In Fig. 3 is shown the original path with the weightless elevators, and the path with heavy elevators.

In conclusion, at may be stated that heavy elevators are indirectly a detriment to static stability due to the necessity of moving the center of gravity back to balance the machine. Heavy elevators are also a disadvantage in stunts as they tire the pilot and put a large stress on the control system.

In respect to dynamic stability however, the heavy elevators are an advantage, as the damping factor of the oscilations is proportional to their weight. Taking everything into account, there is no doubt that the static weight of the elevators should be as small as possible, for the damping of the stability and ease of control.

Air Service Special Service Schools

To carry out the general policy of progressive training established by G.O. No. 112, W.D., 1920, the Air Service has obtained approval of the War Department for the establishment of special service schools of the Air Service, as follows: Pilots' schools at Carlstrom Field, Arcadia, Fla., and at March Field, Riverside, Calif. Pursuit school at Rockwell Field, Coronado, Calif. Bombardment school at Ellington Field, Houston, Texas. Observation school and Communications school at Post Field, Fort Sill, Okla. Engineering school, McCook Field, Dayton, Ohio. Storekeepers' school at Wilbur Wright Field, Dayton, Ohio. Photography school at Langley Field, Hampton, Va. Mechanics' school at Kelly Field, San Antonio, Texas. Balloon schools at Ross Field, Arcadia, Calif., and Lee Hall, Va., Airship schools at Brooks Field, San Antonio, Texas, and at Langley Field, Hampton, Va. Air Service Field Officers' school at Langley Field.

The object of this latter school is the instruction of field officers of the Air Service in the proper methods to be used in the employment of Air Service troops in time of war and their training in time of peace; to train officers to become squadron commanders and staff officers; to train future commanding officers in the fundamental duties of command of the larger units; to study aerial tactics with a view to foreseeing future changes and establishing a sound tactical doctrine throughout the Air Service; to secure by interchange of personnel closer liaison with other arms of the Service; to prepare officers of the Air Service for entrance into the General Service schools so that they will suffer no handicap of training as compared with officers of other arms also attending General Service schools. The course of instruction will extend over one academic year and the faculty will be similar to that prescribed by the Army School of the Line.

As a matter of policy, it will be prerequisite to assignment of an officer to command of the larger units, or to higher staff work, that he be a graduate of the Air Service Field Officers' School. For the present, however, officers above the rank of second lieutenant will be detailed upon the recommendation of immediate commanding officers and the Chief of the Air Service. Such details will, of course be made in accordance with special regulations for the school and in the best interests of the Service. In future any officer assigned as a student must have completed training at a pilot school and a specialized school in case of heavier-than-air officers, or must have completed balloon observer and airship pilot training in case of lighter-than-air officers, and must have had at least one year's service on active duty in the field, or be specially selected to attend the school by the Chief of Air Service. In addition to these qualifications, officers on duty with training and tactical units must be specially recommended by their field or post commander, or in the case of staff officers on duty in the office of the Chief of Air Service or other staff officers, must be specially recommended by their immediate commanding officer and the recommendation approved by the Chief of Air Service.

Fundamental training in military subjects and in special technical and tactical subjects necessary for the Air Service will be given in the specialized schools. They will also give basic training peculiar to the Air Service in primary flying, specialized flying, radio, armament, photography and engineering. The course at the Field Officers' School for the academic year 1920-21 was opened Nov. 10, but it is probable that a shorter course will be offered for officers who will be assigned to the School of the Line from the Air Service for the academic year 1921-22. Applications for the Field Officers' School, class of 1921-22, may be submitted up to May 31, 1921.

The Aero Show at Prague

The Czechoslovak Republic has been making great efforts to attain a place in aviation as they realize that they have almost as good an opportunity as many of the older nations in that respect. President Masaryk is one of the leaders in this endeavor and it is due to his work that much of the progress has been made in that country. The exhibition was inaugurated by the Czechoslovak Aviation Club, which is a member of the F. A. I., and was held in the Industrial Palace at Prague from October 23 to November 7.

The government assisted by a grant from the Ministry of National Defence and by the Ministry of Railways giving free transportation for the exhibits. In addition to the official help given, many private individuals gave financial support. The exhibition far exceeded the hopes of its organizers and should prove a stimulus to the home industry which has had to depend largely on imported machines.

The following is the list of the exhibits displayed and a brief description of the more important ones:

Engineering Works, formerly Breitfeld Danek and Co.: Drawings, photos., parts of engines and a complete 230 hp. engine.

"Falco" Aviation Enterprise, Prague: Complete airplane of Brandenburg type, 145 hp., for transport purposes, and various small parts.

"Avia" Association for Repairing and Building of Airplanes, Prague: Experimental "B. H." (Benes-Hajn) monoplane of 35 hp. This is a very interesting design and is the product of two experienced engineers. The machine is practically a cantilever monoplane the wings being supported from above by four slanting struts. The wings are of thick section and taper both toward the tip and the root from the base of the struts. Only wood and three-ply-wood is used in the construction and the factor of safety is 12. The normal carrying capacity is 265 lb. and the weight of the machine loaded is 830. The wing loading is 7.3 lb/sq. ft. and the power loading 23.7 lb/hp. The machine is a single-seater and only an experimental model.

Aviation Association "Bohemia," Prague: Two-seater sport biplane, B-5, 40 hp. This machine is a single bay, dual control biplane. The total weight with two passengers and fuel for three hours is 1150 lb. The wing loading is 5.95 lb/sq. ft., and the power loading is 28.8 lb/hp., The speed is 62 m. p. h.

Kraffer and Sons, Technical Institute, Prague: Representing the Glacier Metal Co.

J. Svoboda and Co., Prague: Helmets, gloves, coats, etc.

Central Aircraft Works, Kbely: A limousine SM and various airplane parts, and three engines with engine parts. The SM is a biplane with Warren strutting and an elliptical fuselage with a well stream-lined cabin. It is claimed that the SM machines were the first Czech machines. It is fitted with a 230 hp. Hiero engine. The cabin seats two. It has a maximum speed of 122 m. p. h. and the climb with full load is 3280 ft. in 3 min. 50 sec. The ceiling is 18,000 ft.

"Aero" Works for the Construction of Airplanes, Prague: The exhibit consists mostly of machines bought in foreign auctions abroad. The firm is specializing in military machines and is getting out a 100 hp. school machine.

"Ikarus" Works: Two-seater Brandenburg biplane powered with a 165 Mercedes, fitted up as a limousine.

Auto-Moto-Aero-Central, Prague: Various instruments and accessories.

Czechoslovakian State Meteorological Institute, Prague: Instruments for atmospheric measurements, diagrams, etc., an extremely complete collection of exhibits.

Czechoslovakian Aviation Club, Prague: Historical airplanes of Bleriot type, various models, diagrams, maps, etc.

West Bohemia Aviation Club in Plzen: Models, rotary motors of Urban construction, etc.

Moravian Aero Club in Brno: A biplane glider, the property of the club, constructed by R. Harabus; span 20 ft., length 13 ft., wing area 130 sq. ft. Monoplane glider "Valette;" span 24.6 ft., length 15 ft., wing area 160 sq. ft., weight 60 lb.; and many other models, etc.

Technical Museum, Prague: Historical documents relating to aviation in Czechoslovakia.

Ministry of National Defence: Complete Voisin, Salmson, LV-9, Spad and Breguet airplanes.

Bohemia Association for the Refining of Petrol, in Kolin: Exhibits of petrol and oils.

Vladimir Helmhacker: Printing frames.

An exhibition of inventions and aero photos particularly flight photos taken in Siberia.

The show as a whole demonstrates that the Czechs are resolved to use aviation in every way. The results attained far exceeded the hopes of the organizers. The Czechs are trying to get Prague recognized as the center of air travel in Europe and for this reason are getting the airport at Kbely in first class shape and equipped with radio, meteorological apparatus, etc.

Hot Spark for Starting

When airplane engines are turned over by hand it is sometimes difficult to generate a hot enough spark for the magneto. To overcome this difficulty the American Bosch Magneto Co. have placed on the market an adjustable magneto coupling that gives the armature a short, quick turn and

THE PARTS OF THE BOSCH IMPULSE COUPLING

automatically disconnects itself when the speed of the engine reaches 100 to 120 r.p.m. When the engine is cranked, the impulse coupling is in its normal position the tongue of one of the arrester weights rests against the arrester block and holds the housing stationary. As the engine is turned further, the driving flange revolves and winds up a spring. At a fixed point one of the cams on the driving flange lifts the arrester weight clear of the arrester block and the wound spring is released giving the magneto armature a quick turn.

When this impulse coupling is used to start an engine, it is absolutely impossible for the engine to back fire, because the adjustment is such that when cranking the spark occurs only after the piston has passed top dead center.

Air Fleet Cruise

If the plans submitted by the Atlantic Fleet Air Force for the winter cruise are approved, the air boats will leave Philadelphia for the south the middle of December accompanied by the aircraft tenders—the *U. S. S. Shawmut, U. S. S. Harding* and *U. S. S. Sandpiper.*

The Air Force will fly down the Atlantic Coast to Guantanamo, Cuba, arriving there about the middle of January. It will then proceed to Colon where the planes will be overhauled. The trip back to Cuba will be made in February.

The shipplane division of the Atlantic Fleet, which is composed of land planes capable of flying from the turrets of battleships, is now based at Mitchel Field, and will early in December be ready for embarkation on the battleships. The shipplanes will, therefore, also be with the Atlantic Fleet on the winter cruise.

It is hoped that this cruise will surpass in accomplishment the memorable airboat cruise made last winter in which 71,545 miles were covered by six airboats accompanying the Atlantic Fleet without a casualty or mishap of any kind.

NC Planes With Pacific Fleet

A division of NC seaplanes has been detailed to the Pacific Fleet and will accompany the fleet the same as surface craft hereafter, the Navy Department announces. A seaplane tender will be assigned to them to be used for refueling, housing and overhaul purposes. The Navy Department withheld the number of seaplanes and details as to flying personnel to be attached to the U. S. Pacific Fleet.

U. S. Represented on Aircraft Commission

Acting upon a request from the Secretary of the International Aircraft Standards Commission, that arrangements be made, if possible, for American participation in the next meeting of the Commission, the American Engineering Standards Committee invited the various Government and industrial organizations interested in aircraft standardization, to send representatives to a conference to discuss the question. The conference, which was held in Washington on August 11, was attended by representatives of the Departments of War, Navy, Post Office, Commerce, and Agriculture, the National Advisory Committee for Aeronautics, the Society of Automotive Engineers, the Manufacturers Aircraft Association, Inc., the American Society of Mechanical Engineers, and the American Society for Testing Materials.

It was the unanimous view of the conference that there should be American participation. A committee was appointed to present the matter to the President through Newton D. Baker, the Chairman of the Council of National Defense. As a result the President addressed the following letter to the National Advisory Committee for Aeronautics requesting it to arrange for the presence of American representatives at the conference:

Professor J. S. Ames,
Chairman, Executive Committee,
National Advisory Committee for Aeronautics,
Washington, D. C.

My dear Dr. Ames:

The failure of the bill introduced into the Congress to authorize official American participation in the plenary meeting of the International Aircraft Standards Commission in Paris in November of course makes it impossible for us to select delegates who can have a status which would have been possible had that measure passed. It seems to me, however, important that there should be American representation at the conference, and I would be glad if the National Advisory Committee for Aeronautics could arrange to have Americans present, representing the National Advisory Committee and, unofficially, America. I understand that the international conference will have no power to make any engagements or commitments, but will merely suggest standards for recommendation to the appropriate authorities of the several countries. If you could select and secure the presence of delegates who could bring back the recommendations and debates at the conference, I have no doubt their report will be very helpful to the appropriate committees of the Congress and to those executive officers who deal with such matters.

Cordially yours,
WOODROW WILSON.

The National Advisory Committee for Aeronautics has been advised by General Secretary Le Maistre, of the International Aircraft Standards Commission, that the meeting of the Commission will be held in Paris the early part of January. American representation will be available at this conference, the National Advisory Committee having delegated its foreign representatives as unofficial observers for the United States.

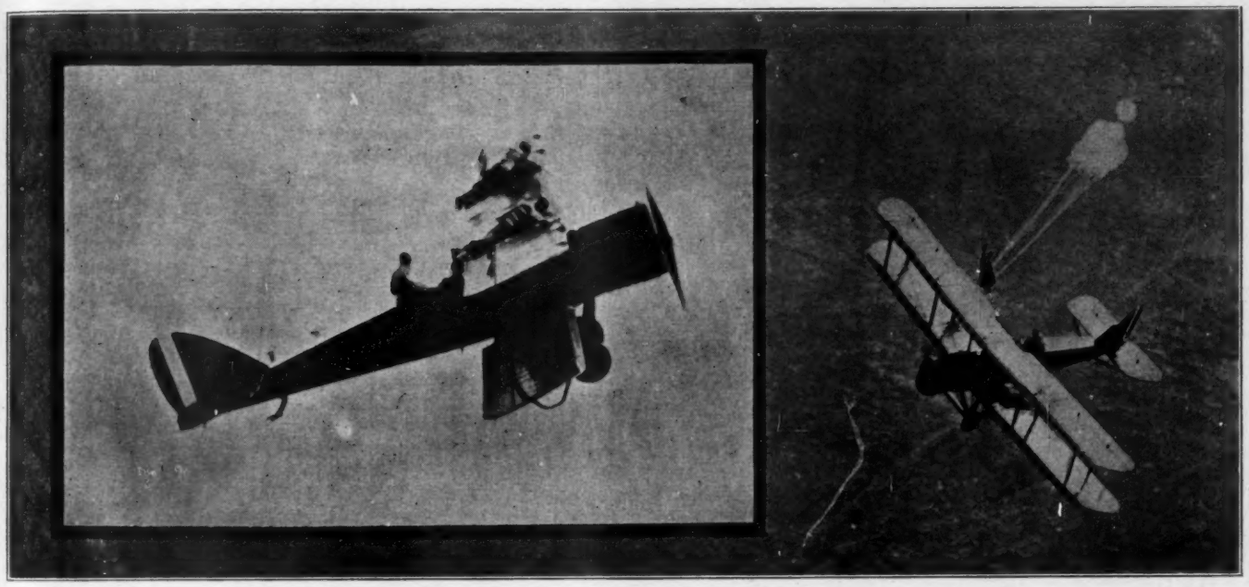
Burnelli Visits New York

Vincent J. Burnelli, chief engineer and factory superintendent of the Nebraska Aircraft Corp. of Lincoln, Nebr., recently visited New York on business. He answered the question "Is there such a thing as commercial aviation in the west?" with a vigorous affirmative.

The Nebraska Aircraft Corp. will be remembered as the company which purchased a large part of the machinery equipment and parts of the Standard Aircraft Corp. of Elizabeth, N. J., and took over from the Government all its surplus Standad J-1 training machines. These the company has been rebuilding with the 180 hp. Wright engine, and Mr. Burnelli states that they have sold over one hundred of these machines during the past year. These planes have been engaged in varied lines of commercial aviation in the middle and far west.

The company also has built a number of planes to Mr. Burnelli's designs. One of these, an enclosed cabin type, is owned by a prominent physician of Nebraska who employs a pilot and uses the plane in visiting seven widely separated hospitals. This physician, Mr. Burnelli states, has traveled a sufficient number of air miles during the past year to encircle the globe seven times.

Mr. Burnelli stated that his company is enlarging its manufacturing facilities for commercial planes on the strength of their successful experience during the past eighteen months and the prospective demand in the west.



AN INTERESTING EXPERIMENT BY THE ARMY AIR SERVICE
Photo U. S. Air Service

A. B. Crehore out of Aero Imports Corp.

Friends of Austen B. Crehore in the aircraft industry were greatly surprised to learn last week that he had sold all his interest in the Aero Import Corp. and had resigned as an officer of the company so as to enable him to devote his entire time to his expanding insurance business. Mr. Crehore has been one of the most popular young men identified with aviation. He was a member of the famous Lafayette Escadrille during the war.

In the New York-Toronto race he was badly injured in a crash but recovered after a period of several months in the hospital. Since that time he has been the active head of the Aero Import Corp. in the sale of the SVA planes in this country. The performance of the SVA piloted by Bert Acosta in the Pulitzer Trophy Race on Thanksgiving Day when, against a field of 32 starters it secured third place with a 220 hp. engine compared to the 638 hp. of the winner, will be long remembered.

Another Key West-Havana Air Line

The Transair Co. incorporated under the laws of the state of Delaware for $300,000, and having general offices at 522 Fifth Avenue, New York, have just launched an enterprise in commercial aeronautics. They will operate an aerial transportation line carrying passengers, express and freight between Key West and Havana.

They expect their first passenger boats to be in operation by January 15. At present steamers plying between Key West and Havana, a distance of 92 miles, require an average of six hours to make the trip. The same journey will be performed by the large luxurious aerial yachts of the Transair Co., in one hour, with the greatest ease and comfort. A saving of five hours between the United States and Cuba will thus be effected.

The officers of the company are F. E. Loudy, president; T. G. LaManna, vice-president and secretary and A. G. Augente, treasurer.

Three F-5-L naval flying boats, converted into magnificent passenger planes will be put into service for the Key West-Havana line. Two of them will operate on regular schedule, making two round trips per day meeting all trains. These planes each have a carrying capacity of fifteen passengers, 1000 lb. of express and fuel sufficient to make two round trips. They are fifty feet in length, are equipped with two Liberty motors of 400 hp. each and have a wing spread of 104 ft. and are capable of flying at the rate of 100 m.p.h. They are handsomely appointed and exquisitely furnished in gray leather and mahogany. The planes have two cabins, one forward and one aft. A passageway connects the two. The forward cabin with its large windows affords unexcelled vision and observation, while the after cabin is furnished as a club compartment suitable for playing cards, or may be used for servants or children. For the convenience of patrons, accommodations are provided for personal baggage.

The company has secured space for a landing stage at Key West at the foot of Vernon street, near LaBrisa. The landing place in Havana will be at Cortina De Valdes which has already been secured. Arrangements will soon be completed for the construction of terminals at both of these points.

The Transair Co. is the second aerial company to start an air line between Key West and Havana.

Fly 1,864 Miles Over Sea

Two Portuguese aviation officers, Cap. Brito Paes and Lieut. Sarmento Beires, have just come within 250 miles of making a record non-stop round-trip flight from Lisbon to Maderia, a distance of about 1,500 km. each way, over the sea. Their average velocity during the trip of approximately 1,864 miles was 112½ miles an hour.

Failure of their gasoline supply compelled their descent before the voyage was completed. They descended on latitude 35.11 north, longitude 13.4 west, which is about 240 miles from Funchal. They were rescued by the British steamer Cambia River. The airplane disappeared from view soon after the pilots abandoned it and is supposed to have sunk.

The original intention of the aviators was to make an over-sea, non-stop flight from Lisbon to Maderia. Owing to cloudy weather and low visibility and because of damages sustained to the compass of the machine, they failed to find the island proper, but their chart shows that they actually reached the longitude of Maderia some miles north of the island, then headed southwest in the fog, then south and then northeast, with the result that they passed entirely around the island without realizing where they were. They headed back in the fog for the mouth of the Tagus River and would have completed a record journey had not the gasoline supply, which they had expected to replenish at Maderia failed them.

Airway from Canada to New York

The Canada Steamship Lines, Ltd., plans next summer to start an aerial passenger service between Montreal, Toronto, and New York, according to J. W. Norcross, head of the concern. Water courses will be followed. The planes will carry twelve passengers and two pilots.

Permanent Commissions for N. R. F. C.

In May, 1921, examinations will be held in the Navy for the transfer to appointments in permanent ranks in the Navy of officers holding temporary commissions and members of the Naval Reserve Force. The number of officers so transferred will not exceed 1200 officers of the line of which number 500 may be appointed from Class 5, Naval Reserve Flying Corps.

Members of the Naval Reserve Force with commissioned ranks who are not more than 35 years of age, or whose age is not greater than 35 years plus their total former naval service, who qualify by the required examination are eligible for transfer to the permanent commissioned line of the Navy.

The examination will be divided into several general subjects and in the case of examinations for aviation duty, questions on aviation will be substituted for one of these subjects. A knowledge of aviation will, therefore, be of considerable assistance in the examination for aviation duties. It is interesting to note that officers' records will count 200 per cent more than any other subject.

One hundred thirty-two naval Reserve officers, Class 5 have applied to take this examination. One hundred three of this number are on active duty and thirty-two on inactive duty. The Navy Department has sent letters to all Class 5 Aviation officers who are on inactive duty enclosing examination application blanks.

Record Mail Flight

The first nonstop flight between Reno, Nev., and Salt Lake was made recently by Pilot Kenneth R. Unger, United States Air Mail Service, who brought down eleven German planes while serving with the British Royal Flying Corps during the war. Unger made the flight of 437 miles in three hours and twenty-four minutes. The plane carried fifty pounds of mail.

Pilot Unger hopped off from Reno at 9:58 o'clock, Pacific time, and arrived in Salt Lake at 2:22 o'clock, mountain time. The air mail plane passed over Elko at 11:40 o'clock, Pacific time, and arrived at Salt Lake City one hour and forty-two minutes later. This equals the record time between Elko and Salt Lake made several weeks ago by Pilot John L. Eaton. Unger undoubtedly set a record for quick flying between Reno and Elko, according to Claron Nelson manager of the Salt Lake air mail landing field.

Quick Remodeling and Delivery

Lieut. George W. Goddard made a fast flight from Dayton, Ohio, to Washington, D. C., recently, covering the 400 miles in three hours and twenty minutes. He first flew to Dayton from Washington in a DH-4B bucking the wind all the way and taking five and a half hours to make the distance. The purpose of the trip to Dayton was to have the DH-4B remodeled and converted into a photographic plane which will be used for mapping purposes around Washington.

Less than a week's time was consumed between the start from Washington, the remodeling of the plane at Dayton, and the return to Washington. On the return flight Lieut. Goddard had the wind with him, and made the distance from Dayton to Moundsville, W. V., in one hour and twenty minutes, thence to Washington in 2 hours.

Mail Speed Record

All records for flying between Chicago and New York were broken December 3 by the Air Mail Service. J. T. Cristensen, leaving Chicago at 6:55 a.m., flew to Cleveland, 319 miles, at the rate of 117 m.p.h., and W. L. Smith flew from Cleveland to New York at the rate of 151 m.p.h., arriving there at 1:25 p.m. An average speed of 131 m.p.h. was maintained between Chicago and New York—an air line distance of 742 miles. The actual flying time between these points was 5 hr. and 31 min. The fastest train time is 20 hr. DeHaviland single-engined planes were used, a change of planes being made at Cleveland.

—AND NOW EVEN ITS NAME IS AMERICAN!

WITH the many mechanical changes and improvements in design now effective the original American-made Hispano-Suiza Engine becomes in name as well as in effect a purely American product and will henceforth be called the Wright Aeronautical Engine.

The original conception of the Hispano screwed cylinder sleeve is substantially the only remaining foreign-conceived part of the design and for several years all Wright-built models of this most successful engine have been of American design replete with improvements over the original foreign model.

Such an outstanding American achievement deserves the typically American name of this Company which has stood and still stands for all that is best in Aeronautical engineering.

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Member Manufacturers' Aircraft Association

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4. PROPERTY DAMAGE (Damage to the property of others).

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Windstorm, Cyclone, Tornado—Passenger Carrying Permit—Stranding and Sinking Clause—Demonstration Permit—Instruction Permit

AGENTS IN CITIES, TOWNS AND VILLAGES THROUGHOUT THE UNITED STATES AND ITS POSSESSIONS, AND IN CANADA, MEXICO, CUBA, PORTO RICO AND CENTRAL AMERICA

Aircraft, Automobile, Fire and Lightning, Explosion, Hail, Marine (Inland and Ocean), Parcel Post, Profits and Commissions, Registered Mail, Rents, Rental Values, Riot and Civil Commotion, Sprinkler Leakage, Tourists' Baggage, Use and Occupancy, Windstorm

STRENGTH REPUTATION SERVICE